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# PATENT SPECIFICATION

810,528

Inventor:—JOHN JAMES POTTER.



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International Classification:—F07f.

## COMPLETE SPECIFICATION.

### Improvements in or relating to Infusion Equipment for Shot-Firing.

We, HAYDEN-NILOS LIMITED, a British Company, of Nilos Works, 18 Darnall Road, Sheffield 9, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to infusion equipment for shot-firing of the kind comprising a tube through which pressure-water can be forced to effect infusion beyond the end of the tube in a drilled hole into which the tube is inserted, the tube being provided with one or more seals and means for compressing the seal or seals lengthwise to expand it or them radially into sealing contact with the wall of the hole. The invention is particularly concerned with a safety catch adapted to be secured on the inner end of the pressure-water tube, and provided with spikes with points directed rearwardly so as to dig into the wall if the explosion of a charge placed in the hole beyond the tube starts an ejecting movement of the equipment.

The object of the present invention is to provide an improved safety catch of this kind, to ensure positive engagement of the spikes with the wall.

According to the present invention, a safety catch comprises an extension adapted to be screwed to the end of an infusion equipment tube of substantially the same outside diameter, with lengthwise recesses in the outside of the extension, spikes lying in the recesses and transversely pivoted towards the forward end of the extension, an axial bore in the extension, openings connecting the recesses with the bore, shoulders on the spikes lying in the openings, and a member slidable in the bore to engage the shoulders and adapted to urge the shoulders rearwardly and thus to cause the spikes to

protrude from the rearward end of the extension.

The member slidable in the bore may be urged rearwardly by a spring, so that the spikes are urged outwardly as the extension is pushed on the infusion tube into the holes, the points of the spikes then being kept by the spring in contact with the wall so that any attempt to withdraw the tube is prevented.

When the hole has been drilled, the infusion equipment may first be inserted without the safety catch, and sealed to the wall of the hole, for a preliminary infusion by pressure-water. The equipment may then be removed, the charge placed in the hole, and the equipment re-inserted, this time with the safety catch. As the catch is pushed along the hole, the spikes are folded back into the recesses against the urge of the spring, their rearwardly-directed pointed ends simply sliding along the wall of the hole until the equipment has been inserted the required distance and once again sealed. If an attempt is now made to withdraw the tube, the spikes, already in engagement with the wall, are urged more and more strongly into the wall by the withdrawing pull and prevent withdrawal.

Therefore, apart from providing a resistance to ejection of the equipment by the force of the explosion of a shot that has been successfully fired, the invention also ensures that the equipment cannot be withdrawn from a hole in which a shot remains unfired: it must remain until another hole has been drilled alongside and fired. The serious danger of an unfired shot being left in an open hole is thus prevented.

The slidable member may, however, serve as a piston, exposed at its forward end, so as to receive the pressure generated by the explosion of the charge in the shot hole.

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Thus, when the shot is fired, the pressure on the piston causes the latter to urge the pointed ends of the spikes powerfully into the walls of the hole, to prevent ejection of the equipment as the force of the explosion falls on the whole end area of the extension.

Such a piston sliding member may also be provided with a spring, as already described, to guard against manual withdrawal, as well as against ejection by the explosion.

The extension preferably has a bore to form a continuation of the bore of the tube, with escape passages to the outside of the extension, thus providing for the passage of pressure-water to the hole beyond the tube and the extension. These passages conveniently lead into the recesses for the spikes, where the flow of pressure-water assists in urging the spikes outwardly, as may be particularly desirable if the sliding member is not spring-urged, but is only intended to be operated by the pressure of the explosion.

The sliding member, if spring-urged, may have a through-bore, continuing the bore in the extension, to provide for the passage of pressure-water beyond the equipment, regardless of whether lateral escape passages are provided in the extension, such as the passages to the recesses mentioned above.

The invention will now be further described with reference to the accompanying drawings, in which:—

Figure 1 is a longitudinal section taken on the line 1—1 of Figure 2, of a shot hole and of a spiked safety catch inserted in the hole;

Figure 2 is a view taken from the left-hand end of Figure 1;

Figure 3 corresponds to Figure 1, but shows the spikes driven into the wall of the hole; and

Figure 4 shows a modified catch in a position corresponding to that of Figure 3.

In Figures 1 and 2, a safety catch extension has a body 1 of slightly less diameter than that of the slot hole 2 into which the extension is pushed on the end of infusion equipment, of which the seal 3 is indicated, and also the protruding inner tube 4, which is screwed to fit a tapped bore 5 at the rear of the extension. A sleeve 6 is slidable on the stem 8 of a screw 9 inserted through a separate nose 10 of the extension, and serving to secure the nose to the extension, and a counterbore 11 houses a compression spring 12 to bear on the collared end 7 of the sleeve 6. The inner face of the collar bears on shoulders 13 of spikes 14 (shown as three in number) at points near transverse pivots 15 where the recesses 16 to contain the spikes break into the bore 17 in which the collar slides. Flats 18 on the pivot ends of the spikes 14 engage the face 19 of the nose 10 next to the body 1 of the extension, to limit the outward movement of the spikes

under the urge of the spring 12 (see Figure 3).

The tapped bore 5 leads to a smaller bore 20 with lateral branches 21 to the spike recesses 16.

The catch extension is quite compact, and may be readily carried by the operator, ready for application by simple screwing to the infusion equipment before the latter is inserted after the insertion of a charge in the shot hole. It need only be tightened by hand. The spikes 14 fold back into the recesses 16, as in Figure 1, as the extension is pushed along the hole 2, the points 22 of the spike simply sliding along the wall of the hole. If it is attempted to withdraw the equipment, the points 22 immediately try to dig into the wall, to which they are urged by the spring 12, particularly in the case of relatively soft material such as coal. When the shot is fired, the force of the explosion on the nose 10 forces the extension and the infusion equipment back a little, but the movement is quickly stopped by deep penetration of the spikes into the surrounding material, as in Figure 3, the spikes serving as a grapnel, with further outward pivoting prevented by the engagement of the faces 18 with the nose 10.

In Figure 4, a sliding member 23, with a collar 24 to engage shoulders 25 on spikes 26 as before, has its end face 27 exposed through a counterbore 28 in the nose 29 that houses a spring 30 to bear on the member 23. The pressure of the explosion acts directly on the face 27, so that the spikes 26 are expelled forcibly outwards, to cause the points 31—already in contact with the wall of the hole by the urge of the spring 30—to force themselves into the surrounding material.

Even if the spring 30 is omitted, the force of the explosion forces the points to and into the surrounding material, so that (although it might be possible to withdraw the upsprung spikes out of the hole before the shot was fired) it is not possible for the explosion to eject the equipment.

Figure 4 shows a bore 32 with lateral branches 33 through which all the pressure-water must escape into the recesses 34 for the spikes 26 and thence along the rest of the hole. However, with a spring 30 provided to urge the spikes to the wall of the hole, the member 23 could be bored at 35 in continuation of an extension 36 of the bore 32, as shown in broken lines, so that a direct passage is provided for pressure-water through the nose 29. Where such a direct flow is provided, side branches to the recesses for the spikes may be omitted. However, such side branches may sometimes be of assistance in enabling the flow of pressure-water to urge the spikes into contact with the wall, e.g., in the cases indicated

where no spring urge is provided for the spikes.

**WHAT WE CLAIM IS:—**

1. A safety catch for infusion equipment for shot firing, comprising an extension adapted to be screwed to the end of an infusion equipment tube of substantially the same outside diameter, with lengthwise recesses in the outside of the extension, spikes lying in the recesses and transversely pivoted towards the forward end of the extension, an axial bore in the extension, openings connecting the recesses with the bore, shoulders on the spikes lying in the openings, and a member slidable in the bore to engage the shoulders and adapted to urge the shoulders rearwardly and thus to cause the spikes to protrude from the rearward end of the extension.
2. A safety catch as in Claim 1, wherein the member slidable in the bore is urged rearwardly by a spring.

3. A safety catch as in Claim 1, wherein the slidable member serves as a piston, exposed at its forward end, so as to receive the pressure generated by the explosion of a charge in the shot hole.
4. A safety catch as in Claim 3, wherein the sliding member is also urged rearwardly by a spring.
5. A safety catch as in any of Claims 1 to 4, comprising a bore through the sliding member in continuation of a bore in the body of the catch for the passage of pressure-water.
6. Safety catches for infusion equipment for shot firing, substantially as hereinbefore described with reference to the accompanying drawings.

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**PROVISIONAL SPECIFICATION.**

**Improvements in or relating to Infusion Equipment for Shot-Firing.**

- 40 We, HAYDEN-NILOS LIMITED, a British Company, of Nilos Works, 18 Darnall Road, Sheffield 9, do hereby declare this invention to be described in the following statement:

- 45 This invention relates to infusion equipment for shot-firing of the kind comprising a tube through which pressure-water can be forced to effect infusion beyond the end of the tube in a drilled hole into which the tube is inserted, the tube being provided with one or more seals and means for compressing the seal or seals lengthwise to expand it or them radially into sealing contact with the wall of the hole. The invention is particularly concerned with a safety catch adapted to be secured on the inner end of the pressure-water tube, and provided with spikes with points directed rearwardly so as to dig into the wall if the explosion of a charge placed in the hole beyond the tube starts an ejecting movement of the equipment.

- 55 The object of the present invention is to provide a safety catch of this kind that prevents withdrawal of the equipment from the hole after it has been inserted with the safety catch applied to it.

- 60 According to the present invention, a safety catch comprises an extension of substantially the same outside diameter as the tube and adapted to be screwed to the end of the tube, lengthwise recesses in the outside of the extension, spikes lying in the recesses and transversely pivoted towards the forward end of the extension, an axial

bore in the extension, openings connecting the recesses with the bore, shoulders on the spikes lying in the openings, and a spring-urged member in the bore to engage the shoulders so as to urge the spikes to protrude from the rearward end of the extension.

The extension preferably has a bore to form a continuation of the bore of the tube, with escape passages to the outside of the extension, thus providing for the passage of pressure-water to the hole beyond the tube and the extension. These passages conveniently lead into the recesses for the spikes.

When the hole has been drilled, the infusion equipment may first be inserted without the safety catch, and sealed to the wall of the hole, for a preliminary infusion by pressure-water. The equipment may then be removed, the charge placed in the hole, and the equipment re-inserted, this time with the safety catch. As the catch is pushed along the hole, the spikes are folded back into the recesses against the urge of the spring, their rearwardly-directed pointed ends simply sliding along the wall of the hole. But if an attempt is made to withdraw the tube, the spikes, already in engagement with the wall, are urged more and more strongly into the wall by the withdrawing pull and prevent withdrawal.

Therefore, apart from providing a resistance to ejection of the equipment by the force of the explosion of a shot that has been successfully fired, the invention also

ensures that the equipment cannot be withdrawn from a hole in which a shot remains unfired: it must remain until another hole has been drilled alongside and fired. The serious danger of an unfired shot being left in an open hole is thus prevented.

5 In one embodiment of the invention, the spring-urged member is a collared sleeve slidable on the stem of a screw inserted through a separate nose of the extension, and serving to secure the nose to the extension, a counterbore housing a compression spring to bear on the farther end of the sleeve. The inner face of the collar bears 10 on the shoulders of the spikes (conveniently three in number) at points near the transverse pivots where the spike recesses break into the bore in which the collar slides. 15 Flats on the pivot ends of the spikes may

engage the face of the nose next to the body of the extension, to limit the outward movement of the spikes under the spring urge. 20

The inner end of the extension is bored and tapped to screw on to a screwed projection of the inner tube of the equipment through which the pressure-water is supplied, and this bore leads to a smaller bore with lateral branches to the spike recesses. 25

The catch is quite compact, and may be readily carried by the operator, ready for application by simple screwing to the infusion equipment before the latter is inserted after the insertion of a charge. 30

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FIG. 1.

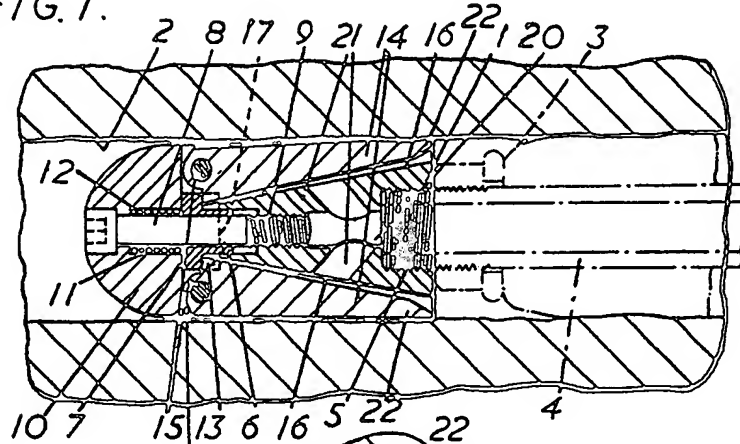


FIG. 3.

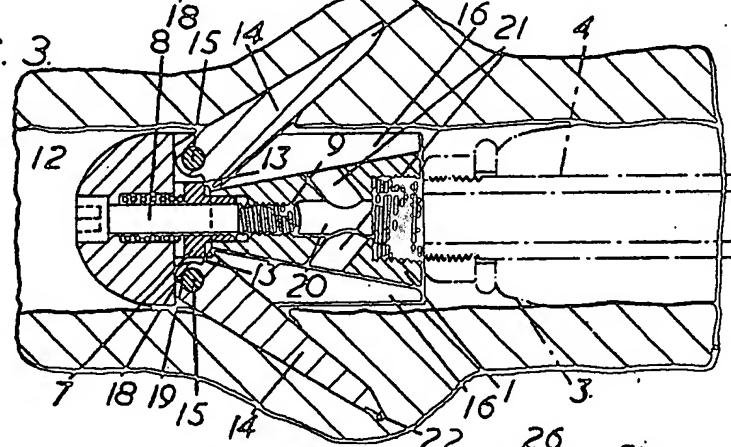


FIG. 2.

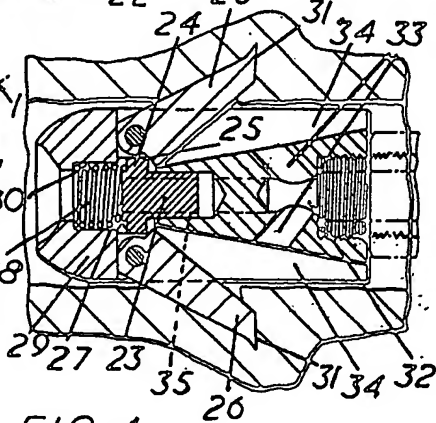
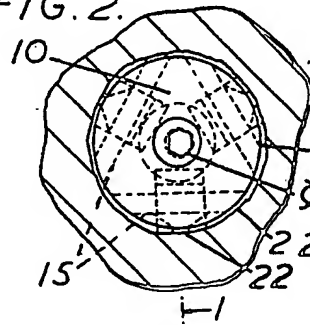


FIG. 4.